

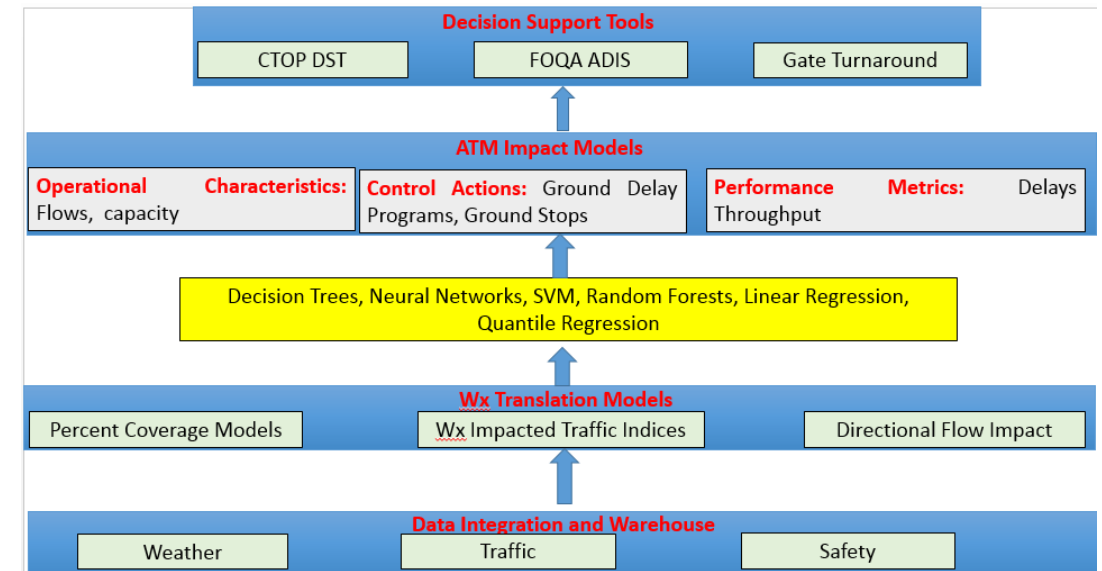
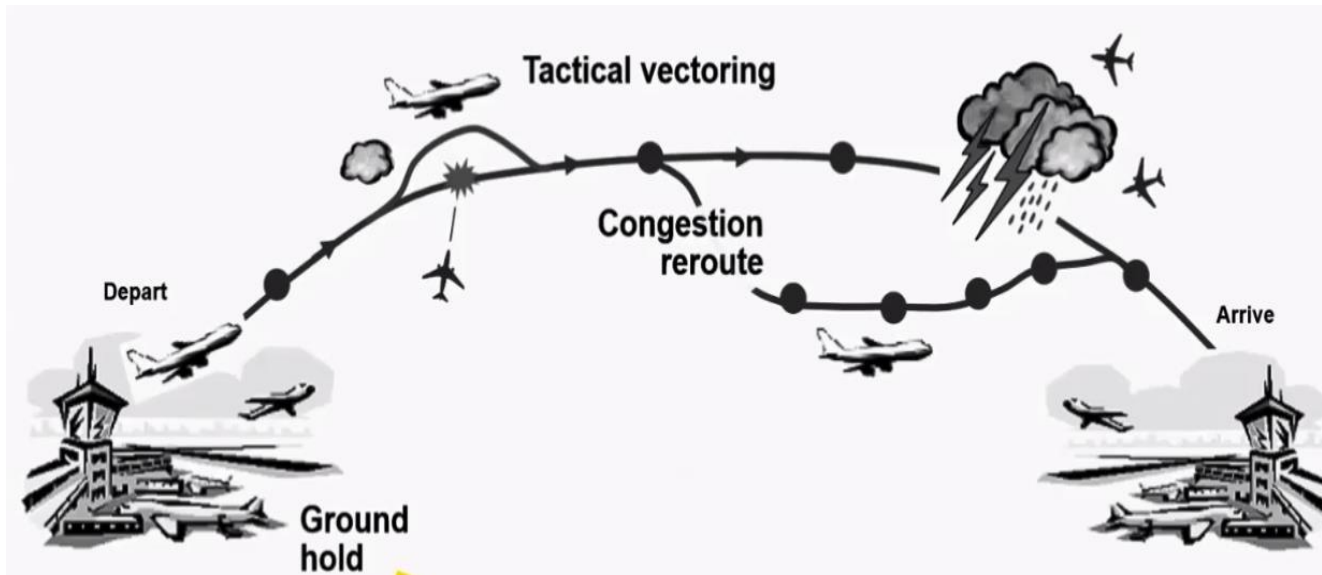


Weather Impact on Air Traffic

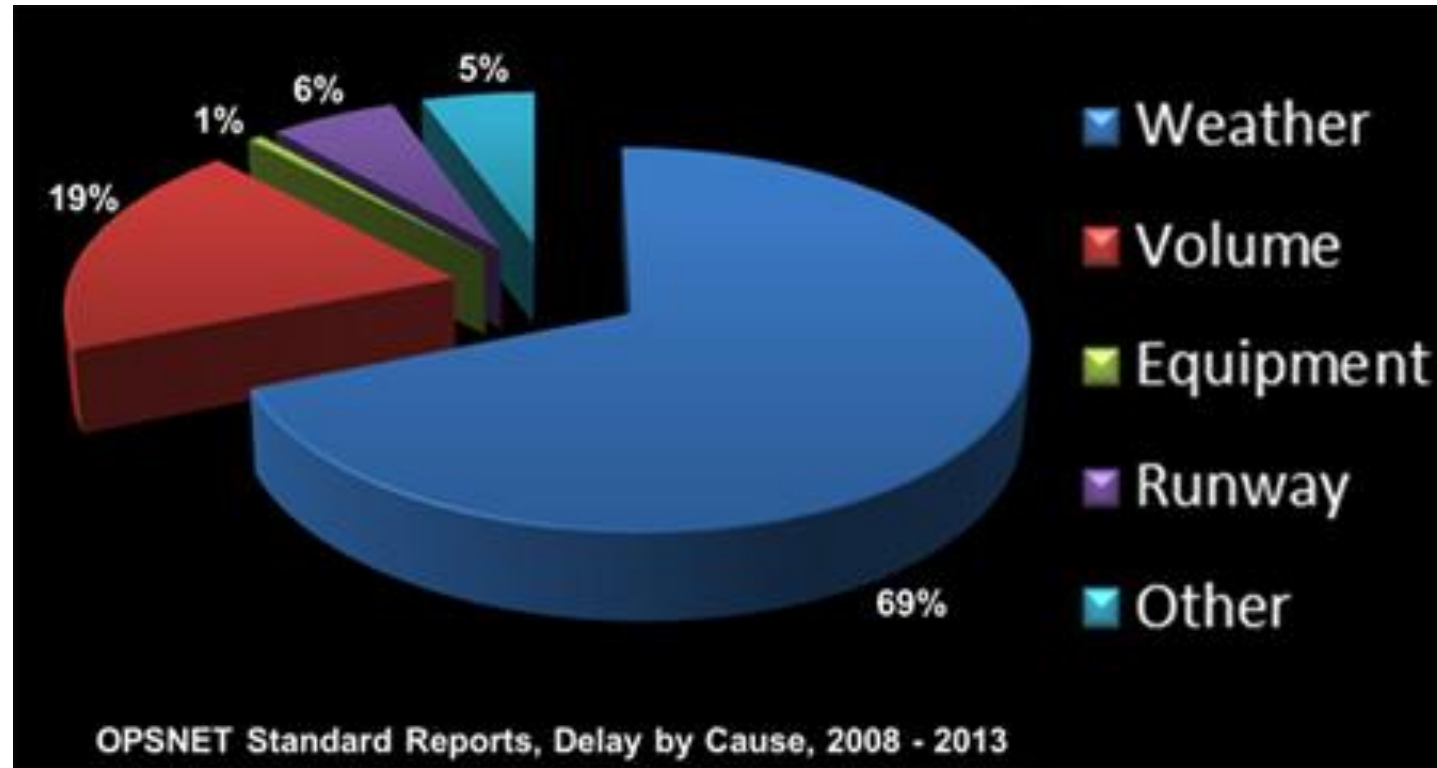
Models of Weather Impact on Air Traffic

Deepak Kulkarni

Yao Wang



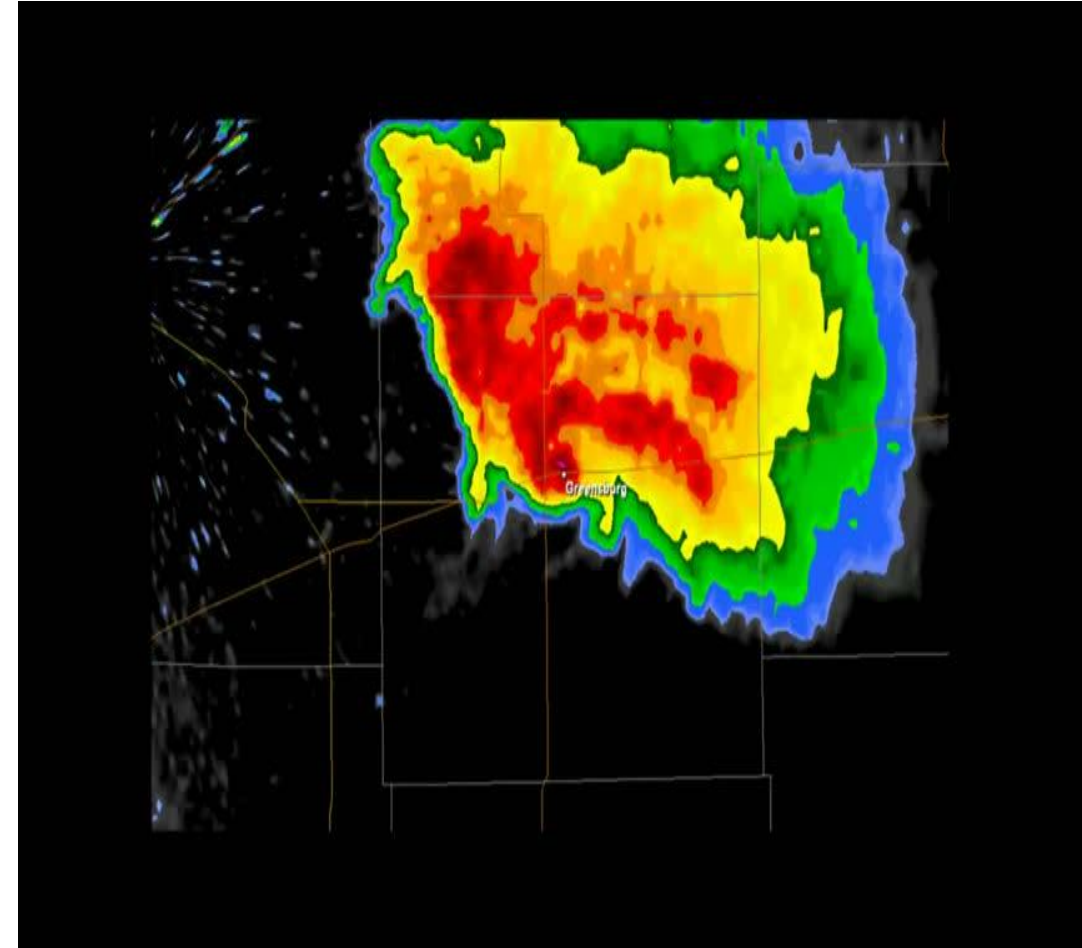
Weather is the largest cause of delays



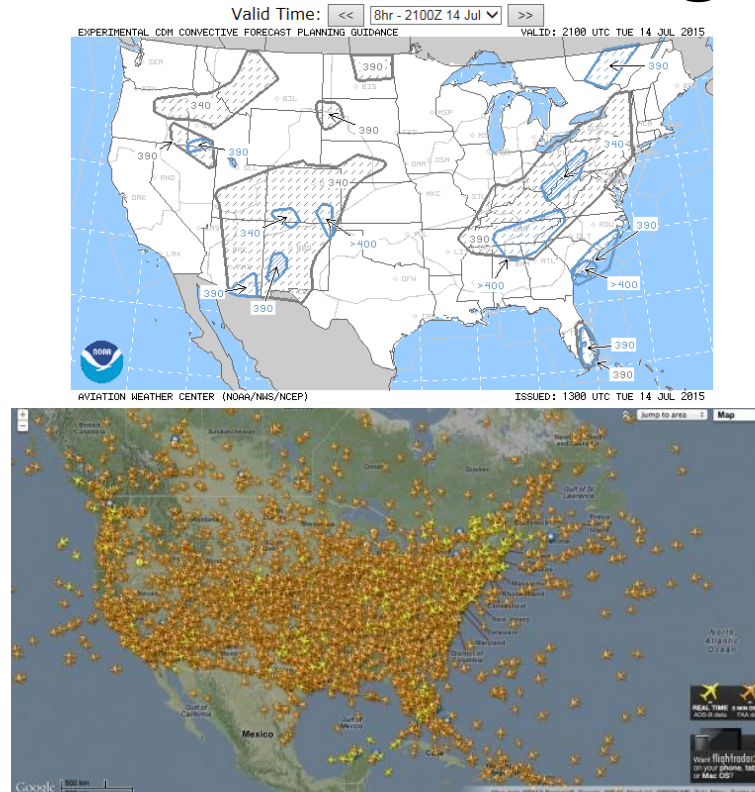
- Estimated annual cost of delays is about 30 billion per year.
- Two thirds of weather delays are avoidable.

Avoidable weather delay challenge

- Most weather support to ATM is manual, with weather displays that must be interpreted by the user
- Weather products do not have the maturity nor are they translated into impact information required for direct insertion without interpretation
- Rules for interpretation and use of weather data are generally based on the experience of the user
- It is hard for decision makers to handle uncertainty in prediction of weather and air traffic demand
- ATM decisions based upon today's weather products are inconsistent from user to user



Weather ATM integration challenge



Flight	Time	Status	Gate
ATLANTA	2.31p	DELAYED	B3
NEW YORK	2.34p	DELAYED	C12
BOSTON	2.35p	CANCELLED	C14
LONDON	2.37p	DELAYED	A4
NEWARK	2.40p	DELAYED	B9
LOS ANGELES	2.44p	DELAYED	C9
VANCOUVER	2.47p	CANCELLED	A7
MIAMI	2.49p	DELAYED	B11
NEWARK	2.53p	DELAYED	C6
CHICAGO	2.56p	CANCELLED	B3
SEATTLE	3.02p	DELAYED	C17
MONTREAL	3.06p	CANCELLED	A10
DETROIT	3.07p	DELAYED	C5

- Given predicted weather, manage air traffic so as to minimize delays, cancellations and safety incidents
- Current state of operations: Sub-optimal operations, high level of controller workload
- Challenges: Complexity with the large number of aircraft involved, Weather impact assessment, Weather unpredictability
- Future state of operations: Wx ATM integration via Decision Support Systems.

The Operational Actors

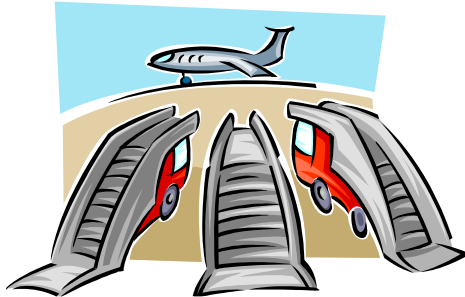
Pilot



Dispatcher



Ramp Controller



GA Operators /
Flight Plan Service Providers

AOC



ATC

Ground Controller

Local Controller

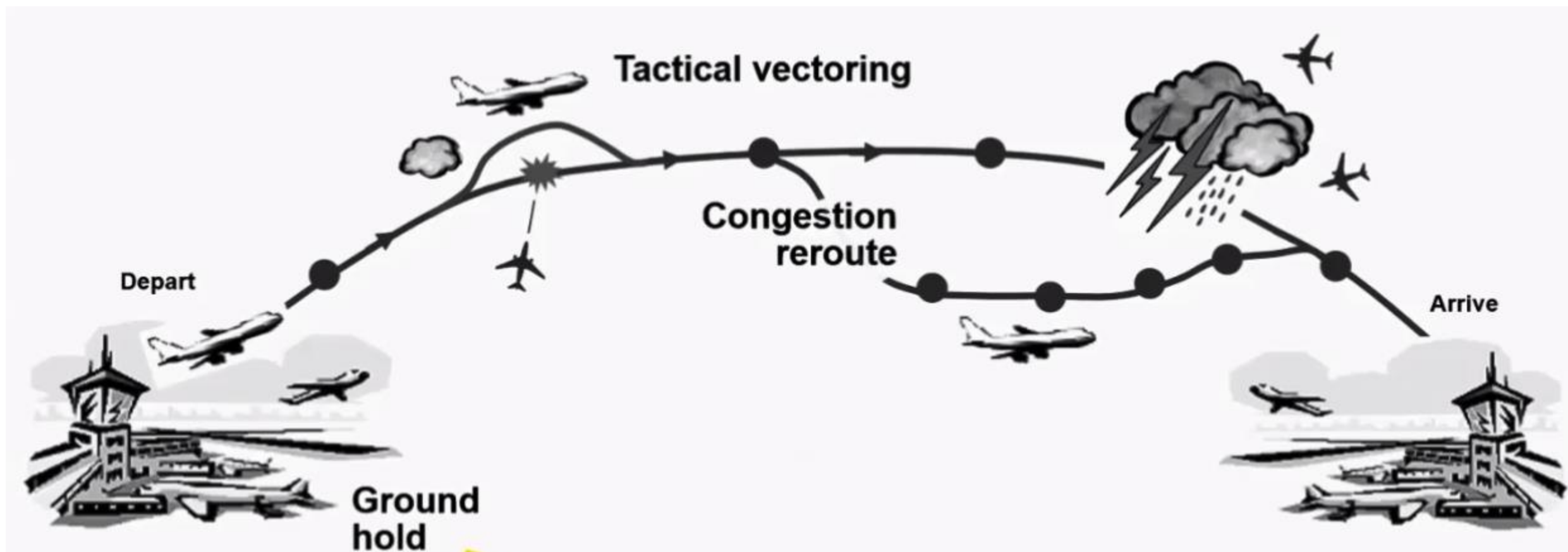
Clearance Delivery

En-route Controller

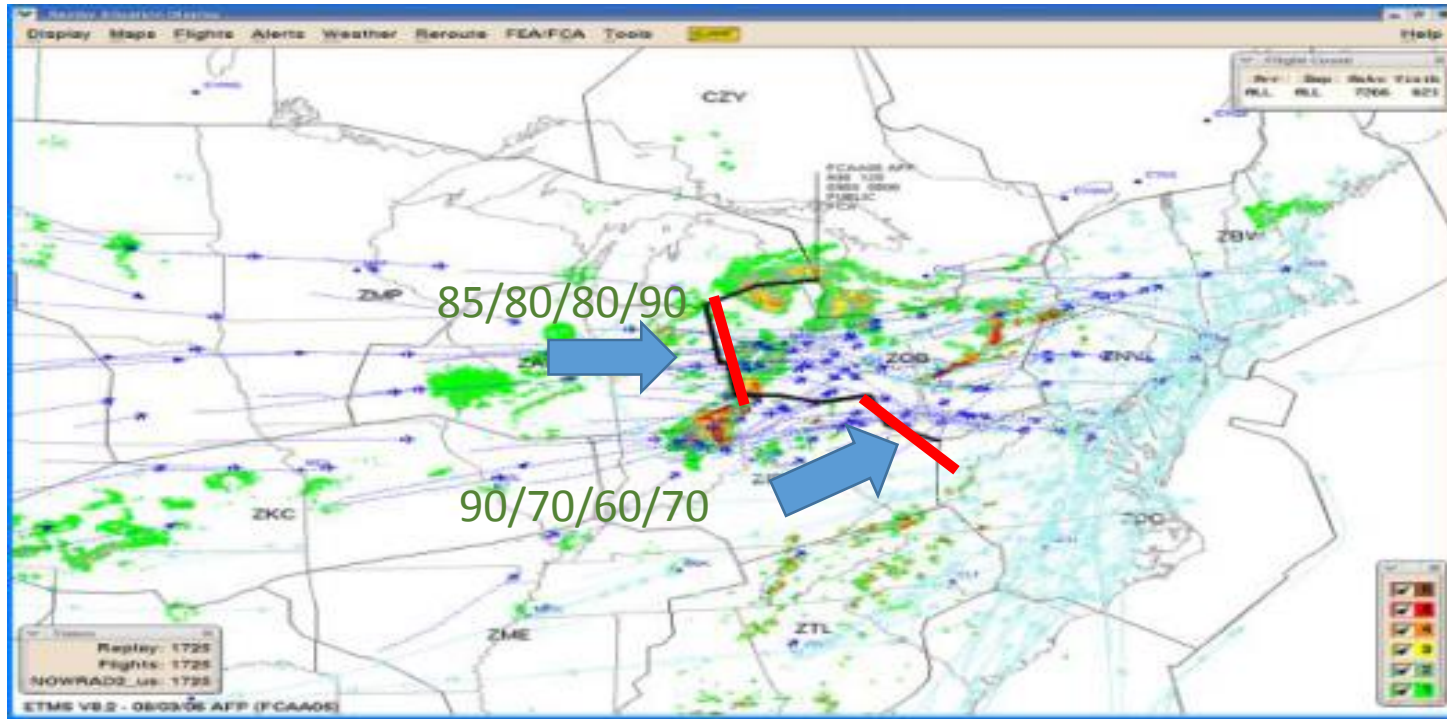
FLM

TMC's





Data => Optimal ATM Control Decisions and
Support for What-if reasoning



Possible options and consequences

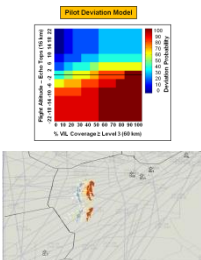
Levels of ATM-Weather Integration



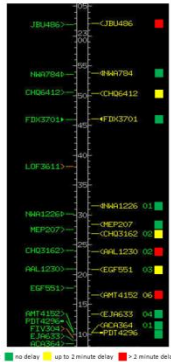
Separate Visualization



Integrated Visualization



Weather Constraints on ATM



ATM Impacts

Decision Support Tools

